WHAT IS CLAIMED IS:

We Claim:

1. A method for use in measuring the volume of fuel in a fuel tank in a vehicle subject to varying external forces caused by movement and roll and pitch angles of the vehicle, comprising the steps of:

mounting a fuel tank to the vehicle so that it is movable along the yaw or vertical axis of the vehicle;

providing at least one analog signal in proportion respectively to the load on at least one tank load cell, each of the cells being placed between a portion of the fuel tank and a portion of a reference surface of the vehicle, and the cells being sensitive along an axis substantially normal to the reference surface and generally parallel to the yaw axis of the vehicle;

providing signals proportionally representing the pitch or roll angles of said vehicle; and

converting the at least one analog cell signal and the pitch or roll angle signals into output information representative of the volume of the liquid in the fuel tank by converting the at least one analog cell signal to a digital signal and inputting the digital signal and the pitch and roll signals into a processor having an algorithm, the algorithm using (i) the inputted at least one analog cell signal and the pitch or roll signals independently (ii) with a derived relationship between the signals and the fuel volume to output the fuel volume information.

2. An apparatus for use in measuring the volume of a liquid in a fuel tank in a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, comprising:

a fuel tank mounted to the vehicle and subject to forces along the yaw axis of the vehicle;

at least one tank load cell for providing an output proportionally representing the load on said load cell, said load cell being mounted between a portion of said fuel tank and a portion of a reference surface of the vehicle, said load cells being sensitive along an axis that is substantially normal to said mounting surface and generally parallel to the yaw axis of the vehicle; and,

computational means for performing a derived relationship between said load cell output and the volume of fuel in said tank so as to convert said output signal from said load cell into output information representative of the volume of the fuel in said tank.

3. An apparatus for use in measuring the volume of a liquid in a fuel tank in a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, without the use of a reference standard of known weight, comprising:

a fuel tank mounted to the vehicle and subject to forces along the yaw axis of the vehicle;

weighing means for weighing said fuel tank and providing an output signal representative of the weight of said tank;

means for retaining data representative of the known tank empty weight; and,

computational means to perform a derived relationship between the output of said weighing means and the volume of fuel in said tank so as to convert the output of said weighing means into output information representative of the volume of the fuel in said tank.

4. An apparatus for use in measuring the volume of a liquid in a fuel tank in a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, comprising:

a fuel tank mounted to the vehicle and subject to forces along the yaw axis of the vehicle;

level measuring means for measuring the level of fuel in said tank and providing an output signal representative thereof;

angle measuring means for measuring at least one of the pitch or roll angle of the vehicle and providing an output signal representative thereof; and

computational means to convert said output signals from said level measuring means and said angle measuring means into output information representative of the volume of the fuel in said tank.

5. The apparatus of claim 4, wherein said level measuring means comprises a float and variable resistor.

6. The apparatus of claim 4, wherein said level measuring means comprises a variable capacitance capacitor.

7. The apparatus of claim 4, wherein said level measuring means comprises an ultrasonic transmitter and receiver for directing ultrasonic waves toward a surface of the fuel in said tank and receiving ultrasonic waves reflected therefrom.

8. The apparatus of claim 4, wherein said level measuring means an electromagnetic transmitter and receiver for directing electromagnetic waves toward a surface of the fuel in said tank and receiving ultrasonic waves reflected therefrom.

9. The apparatus of claim 4, wherein said computational means comprises a processor embodying a mathematical algorithm.

10. The apparatus of claim 4, wherein said computational means comprises a processor embodying a neural network.

11. An apparatus for use in measuring a level of a liquid in a fuel tank in a vehicle comprising:

a fuel tank mounted to the vehicle;

capacitor means for measuring a level of fuel in said tank and providing having an output signal representative thereof; and

computational means for converting said output signal from said capacitor means into output information representative of a level of the fuel in said tank.

12. The apparatus of claim 11, wherein said capacitor means comprises a tube.

13. The apparatus of claim 11, wherein said capacitor means comprises a plate.

14. The apparatus of claim 11, wherein said capacitor means comprises a pair of horizontal conductive members extending substantially along the top and bottom of said tank.

15. An apparatus for use in measuring a level of a liquid in a fuel tank in a vehicle comprising:

a fuel tank mounted to the vehicle;

ultrasonic means for measuring a level of fuel in said tank and providing an output signal representative thereof; and

computational means for convert said output signal from said ultrasonic means into output information representative of a level of the fuel in said tank.

16. An apparatus for measuring the volume of a liquid in a fuel tank in a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, comprising:

a fuel tank mounted to the vehicle and subject to forces along the yaw axis of the vehicle;

a plurality of SAW pressure sensors mounted on said tank, each of said SAW pressure sensors providing an output signal representative of pressure applied to said SAW pressure sensor by material in an interior of said tank; and

processor means coupled to said SAW pressure sensors for receiving said output signals from said SAW pressure sensors and for processing said output signals to obtain a volume of fuel in said tank, said processor means comprising means for storing an algorithm representative of a derived relationship between the parameters corresponding to said output signals from said SAW pressure sensors and the volume of fuel in said tank and applying the algorithm using said output signals from said SAW pressure sensors as input to obtain the volume of fuel in said tank,

said algorithm being obtained by conducting a plurality of measurements, each measurement including the known volume of the tank and said output signals from said SAW pressure sensors.

17. The apparatus of claim 16, wherein said plurality of SAW pressure sensors comprises four SAW pressure sensors arranged each at a different location on a bottom of said tank.

18. The apparatus of claim 17, wherein said plurality of SAW pressure sensors further comprises a single SAW pressure sensor arranged at a top of said tank, said algorithm being obtained to consider output signals from said SAW pressure sensor arranged at a top of said tank to eliminate effects of vapor pressure within said tank.

19. The apparatus of claim 16, wherein said algorithm is a neural network.

20. A fluid storage tank for a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, comprising

a container having a sidewall defining in part an interior; and

a SAW sensor arranged on said sidewall and including a pressure sensor arranged on an inside of said container and a temperature sensor arranged on an outside of said container, said pressure sensor being arranged to measure deflection of said sidewall and said temperature sensor being arranged to measure temperature of the fluid.

21. A method for measuring the volume of a liquid in a fuel tank in a vehicle subject to varying external forces caused by movement or changes in the roll and pitch angles of the vehicle, comprising the steps of:

conducting a plurality of measurements, each measurement including the known volume of the tank and the value of at least three parameters concerning the tank, at least one of the parameters being the pitch or roll angle of the vehicle as determined by an inertial measurement unit (IMU),

generating an algorithm from the plurality of measurements for determining the volume of fuel in the tank upon the receipt of current values of the parameters,

inputting the algorithm into a processor arranged in connection with the vehicle,

measuring the same parameters during operation of the vehicle, and

inputting the measured parameters into the algorithm in the processor such that the algorithm provides the volume of fuel in the tank.

22. The method of claim 21, wherein the remaining ones of the parameters is selected from the group consisting of the load of the tank on a load cell arranged at a first location, the load of the tank on a load cell arranged at a second location, the load of the tank at a load cell arranged at a third location, the height of the fuel at a first location in the tank, the height of the fuel at a second location in the tank and the height of the fuel at a third location in the tank.